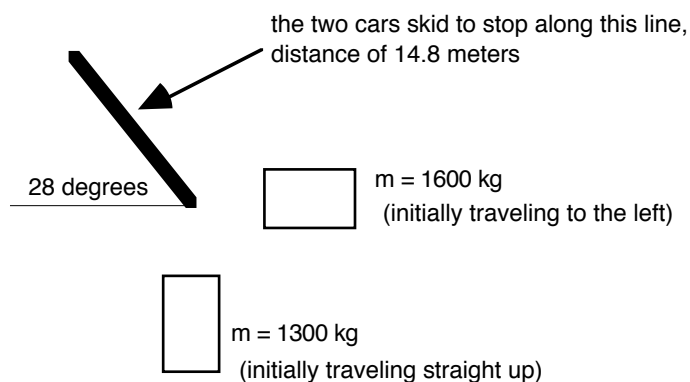


2D Momentum Problems

1. Two cars approach a 90° intersection. Neither driver is paying attention to what they are doing, and they collide. After the collision, the cars stick together, and skid to a stop in 14.8 meters at an angle as shown. The two cars have masses of 1300 kg and 1600 kg, as shown. You happen to know that the coefficient of friction between the tires and the road was $\mu = 0.3$. How fast were the drivers going just prior to the collision?

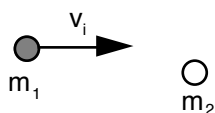


2. A 5 kg object initially at rest explodes into three (unequal) pieces: $\frac{1}{4}$ of the mass has a velocity of $30\mathbf{i}$ m/s after the explosion while $\frac{1}{2}$ of the mass has a velocity of $20\mathbf{j}$ m/s. What is the speed of the third mass after the explosion?
3. An object has some initial velocity when it explodes into two pieces. $\frac{1}{3}$ of the mass has a velocity of 5 m/s at 25° after the explosion. The other $\frac{2}{3}$ of the mass has a velocity of 4 m/s at -50° . (0° would be in the $+\mathbf{i}$ direction.) What was the initial velocity of the whole mass?

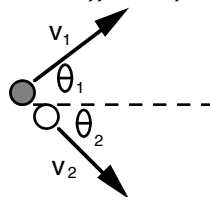
2D Momentum Problems

The 4 to 6 all use the same diagram (but the numbers are different for each problem.)

pre-collision



post-collision



4. A ball of mass 0.2 kg is traveling horizontally with a speed of 3.5 m/s. It collides with a ball of 0.4 kg, initially at rest. After the collision, the first ball is traveling with a velocity of 3 m/s at an angle of 30° above the original direction of motion. What is the velocity of the other ball?

5. $m_1 = 0.25$ kg and $m_2 = 0.15$ kg. The speeds after the collision are $v_1 = 4$ m/s and $v_2 = 6$ m/s. If $\theta_1 = 30^\circ$.
- a. Was the collision elastic? (*Hint: Find the initial speed first.*)

- b. What was the impulse on m_1 ?

2D Momentum Problems

6. Both masses are 0.25 kg. The initial speed of m_1 was 5 m/s and the collision was elastic. If $\theta_2 = 30^\circ$, how fast were the masses going after the collision?

Answers:

- 1) 1600 kg: 15 m/s; 1300 kg: 9.9 m/s 2) 50 m/s 3) $3.23i - 1.34j$ m/s
4) $0.45i - 0.75j$ m/s 5. a) 6.5 m/s; not elastic b) $-0.76i + 0.5j$ Ns
6) $v_1=2.5$ m/s; $v_2=4.3$ m/s